DECLASSIFIED
AUT[illegible] 91/03/26

MINERALOGICAL ANALYSIS OF TAILINGS SAMPLES PROVIDED BY BOOJUM RESEARCH LTD.

by

R.G.L. McCready and J. Salley
Extractive Metallurgy Laboratory

August 1987

Project: 30.86.99
Cost Recovery - Environmental Controls

Job No: 025510

MINERAL SCIENCES LABORATORIES
DIVISION REPORT MSL 87-8 (CR)

6 pp

CONFIDENTIAL

MICROMEDIA

91-04947/

MINERALOGICAL ANALYSIS OF TAILINGS SAMPLES PROVIDED BY BOOJUM RESEARCH LTD.

by

R.G.L. McCready and J. Salley

Extractive Metallurgy Laboratory

ABSTRACT

Samples of sulphide saturated steel wool were treated to recover the sulphide to obtain presumptive data indicating the presence of sulphate-reducing bacteria (S.R.B.). Two sets of organic amendments used in tailings treatment were analyzed for the presence of SRBs and the later set were analyzed for the presence of heterotrophic bacteria.

Keywords: sulphate-reducing bacteria, Desulphovibrio, organic degradation, acid mitigation

1. Estimation of H_2S Production in Tailings Piezometers

Five samples of steelwool labelled 27, 27b, Bock Hill, Clara Pond and Dave Dun, were treated anaerobically with 1:1 HCl and the evolved gas was trapped as silver sulphide in a 5% silver nitrate trap (see Figure 1).

Results:

The silver sulphide was recovered by filtration, dried, weighed and the amount of sulphide released was calculated using the following equation.

$$\text{mg of } S^{=} = \frac{\text{wt of silver sulphide}}{248} \times 32$$

Sample	Mg Ag_2S	Calculated mg $S^{=}$
Dave Dun	123.0	15.9
Bock Hill	125.4	16.2
Clara Pond	115.0	14.8
27	170.0	21.9
27b	112.6	14.5

2. Analyses of Organic Treatments for the Presence of Sulphate-Reducing Bacteria (SRB)

Samples were received from Boojum Research Ltd. labelled saw-dust, overburden, straw and liquid. An aliquot of each sample was placed in a sterile 250 mL screw-cap jar which was subsequently filled with modified Starkey's Liquid Medium. These anaerobic cultures were incubated at 24°C and checked periodically for the presence of black colonies or the production of hydrogen sulphide.

Results:

Sulphate-reducing organisms, presumably Desulphovibrio, were detected in aliquots of three of the four samples submitted. No sulphate-reducing organisms could be detected in the sample labelled "overburden".

The initial cultures obtained from these samples were subcultured into tubes of Starkey's Solid Medium to determine if the punctiform black colonies typical of Desulphovibrio would be observed. Such colonies were observed except from the subculture of the "overburden" sample. A higher cell population was observed from the "sawdust" and "liquid" sample than from the "straw" sample.

Starkey's Liquid Medium

Component	g/L
Peptone	5
Beef Extract	3
Yeast Extract	0.2
$MgSO_4 \cdot 2H_2O$	1.5
*Na_2SO_3	0.25
Na_2SO_4	0.75
*$FeNH_4(SO_4)_2$	0.10
Glucose	5.0 q.s. to 1L with H_2O, pH 7.0

* Added as filter sterilized solutions after cooling of the autoclaved medium.

Starkey's Solid Medium is as above with 20 g of Bacto Agar added per litre.

3. Analyses for Sulphate-Reducing Bacteria in Organic Residues from the Levack Site

Mid-straw, Cell #3a
Peat/Hay, Cell #2
Straw/Sediment, Cell #3
Straw/Hay, Cell #1
Peat, Cell #3, no 1987 addition
Control, No amendment

Aliquots of the first five samples were incubated in 250 mL sterile glass jars containing Starkey's Liquid Medium. All of the samples contained sulphate-reducing bacteria with the highest cell population and hydrogen sulphide generation occurring with the straw/sediment sample from Cell #3.

4. Analyses of Heterotrophic Organisms in the Organic Amendments

Aliquots of the six samples were streaked onto triplicate plates of nutrient agar adjusted to four different pH values; 2.5, 3.0, 4.0 and pH 7.0. Heterotrophic growth occurred at all pH values from all the samples with the exception of the unamended control sample. Fungi and actinomycetes, both of which are capable of metabolizing cellulose and lignocellulose, were the predominant organisms. However, an aciduric, Klebsiella ozaenae was detected on the nutrient agar plates at pH 4.0 and 7.0

In contrast to previous analyses of this material in which a monoculture of a cellulase-producing Bacillus was isolated, the larger diversity of heterotrophs from these samples suggest that extensive degradation and metabolism of the organic amendments has occurred.

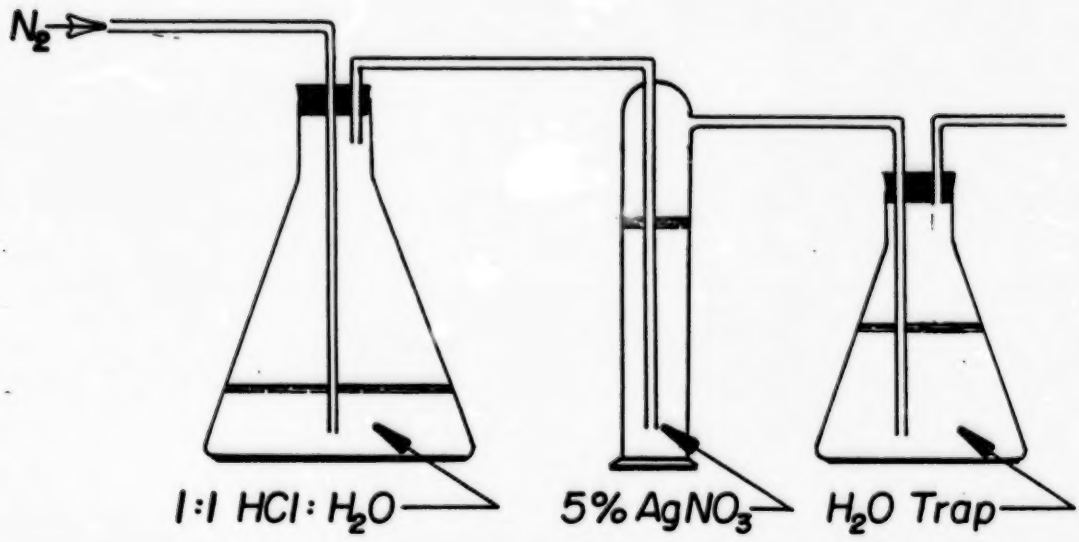

Fig. 1 - Sulphur recovery from steel wool